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Extremal level sets of two-dimensional discrete Gaussian Free Field

I will describe recent progress in the understanding of the behavior of extremal values of the two-dimensional discrete Gaussian Free Field (DGFF). Specifically, for the DGFF over scaled-up versions of bounded continuum domains I will show that the level sets at fractional multiples of the height of the absolute maximum scale, in a suitable sense, to a random measure known as the Liouville Quantum Gravity (LQG). I will also show that the extremal values at heights order-unity below the absolute maximum are distributed according to the Poisson point process with intensity measure whose spatial part is given by a critical LQG measure. Time permitting, I will also discuss the large-scale behavior of the random walk driven by gradients of the field including, possibly, its connections to Liouville Brownian Motion. These turn out to be closely related to level-set analysis discussed above. The lectures will draw from a series of joint papers with O. Louidor and also joint work with J. Ding and S. Goswami.

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